BALD EAGLE ACTIVITY AT AN ARTIFICIAL NEST STRUCTURE IN ARIZONA

by
Teryl G. Grubb
USDA Forest Service
Rocky Mountain Forest and Range Experiment Station
Forestry Sciences Laboratory
ASU Campus
Tempe, Arizona 85287

Abstract

Bald Eagle (*Haliaeetus leucocephalus*) nesting activity was recorded with time-lapse photography at an artificial structure in central Arizona during the 1978-79 breeding season. Nest repair was evident more than 4 months before egg laying, with most activity initially concentrated at dawn and dusk. Nesting efforts continued despite flooding and subsequent human manipulation of the nest. Management implications of artificial nests, survey techniques, and post-failure activity are discussed.

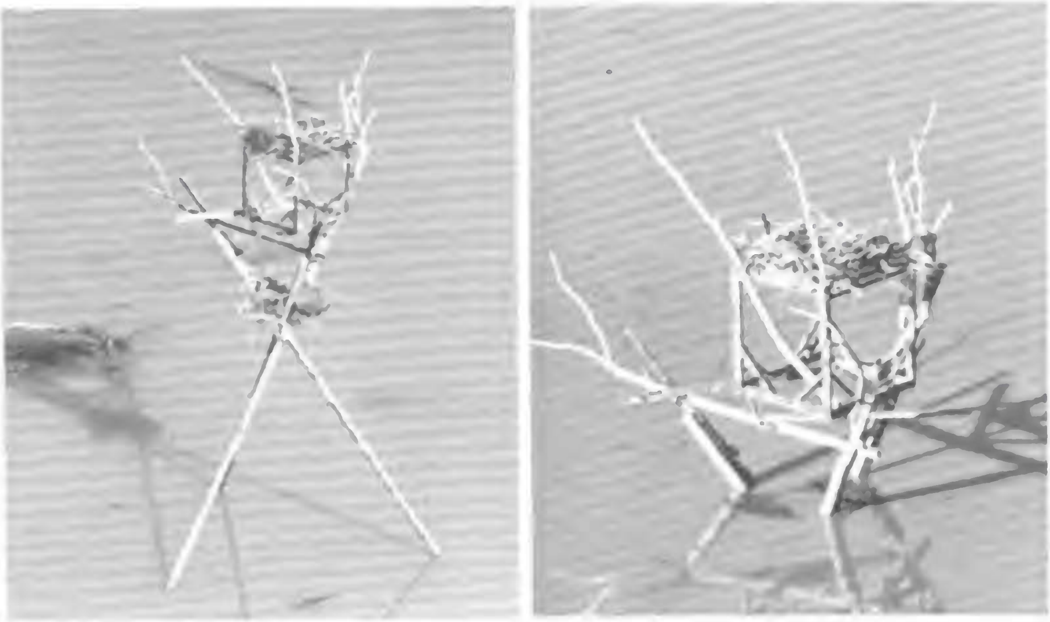
Introduction

The Bald Eagle breeding area observed during this study is located along the Verde River in central Arizona. It was discovered in 1975, when an adult pair was present but unproductive (Rubink and Podborny 1976). Two young were fledged in 1976 although during incubation the reservoir level rose to within 2.5 m of the nest, which fell prior to fledging (Duane Rubink, pers. comm.). In 1977, after high winds toppled the nest tree with two viable eggs (Grubb and Rubink 1978), a tripod made of 10.2 cm aluminum irrigation pipe in 14.3 m lengths, bolted at 12.2 m, was erected to provide support for the original nest (Grubb 1980). During the 1977-78 breeding season time-lapse photography showed the eagles occasionally perching and roosting on the structure, but eventually an alternate cliff nest was used. This paper describes the results of time-lapse monitoring of the tripod from mid-October through mid-April during the 1978-79 breeding season. Nesting activity usually lasts from December until June, with egg laying occurring by late January. The objectives of this study were first, to document Bald Eagle use of the artificial nest structure and the emergency modification described below, and second, to determine the pattern of adult presence at the nest during various stages of the breeding cycle.

Methods

On 21 December 1978, a 1.2-m cubical framework made of 5- x 10-cm studs was placed on top of the tripod after the original nest in the apex (Fig. 1) had been inundated by reservoir waters (Fig. 2). Materials from the original nest were used to construct a new nest on an expanded aluminum grid across the top of the framework. By working nest sticks through the grid holes (1.9 x 5 cm diamond pattern) it was possible to firmly anchor the nest without any special form of attachment. Additional perch branches were wired to the scaffolding, and all bare wood was camouflaged with brown spray paint. The original tripod was designed with a 10.7-m apex height and positioned to approximate the 1977 nest tree height and locaton (Grubb 1980).

A Canon Super 8 movie camera (Model 814XL)[1] equipped with an 8X zoom lens was used in conjunction with a Telonics TIC-2[1] intervelometer to take time-lapse films of the tripod nest from a cliff approximately 60 m away. The



U.S. Forest Service Photos

Figure 1. — (A) Partially exposed tripod support structure showing original Bald Eagle nest and raised nest, and (B) a typical water level that occurred through nest repair and incubation (see Fig. 2), necessitating the scaffolding superstructure.

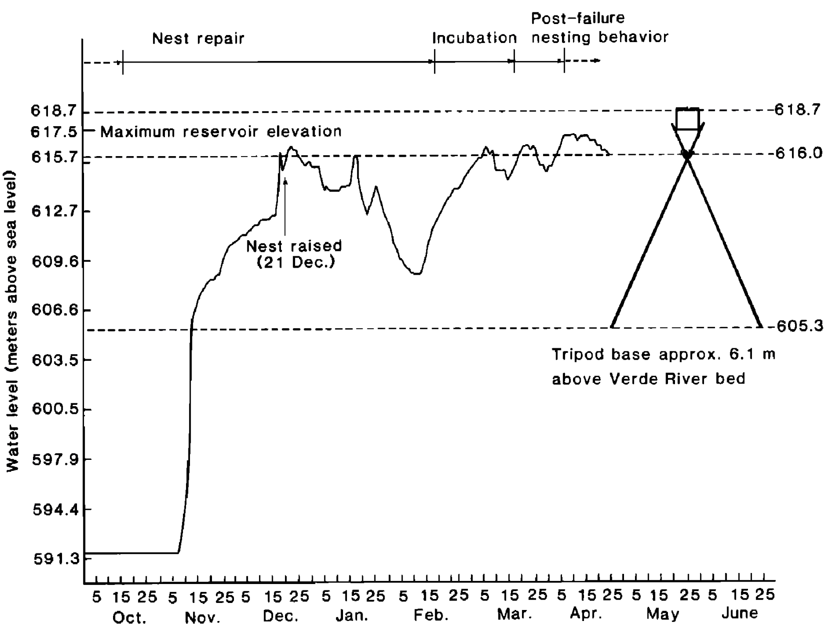


Figure 2. — Horseshoe Reservoir water levels, October 1978 - April 1979, showing the extensive fluctuation that occurred during the Bald Eagles' nesting attempt on the artificial structure.

camera was in the field from 17 October 1978 through 13 April 1979. The film interval was set at 2 frames, 10 seconds apart, every 6 minutes. The second frame of each pair was taken to provide verification of the first frame. On a standard Super 8, 3600-frame (50-foot) cartridge, this provided 15-17 days of daylight coverage. The intervelometer was set to operate only when the camera had enough light to photograph properly. About 1 hour of actual light at dawn and at dusk was lost with the ASA 40 film used. To access the camera with minimal disturbance to the eagles, a low rock blind was built along the cliff face. The author's dog, an Alaskan malemute, was permitted to wander quietly nearby to distract the incubating eagle's attention from the process of changing film.

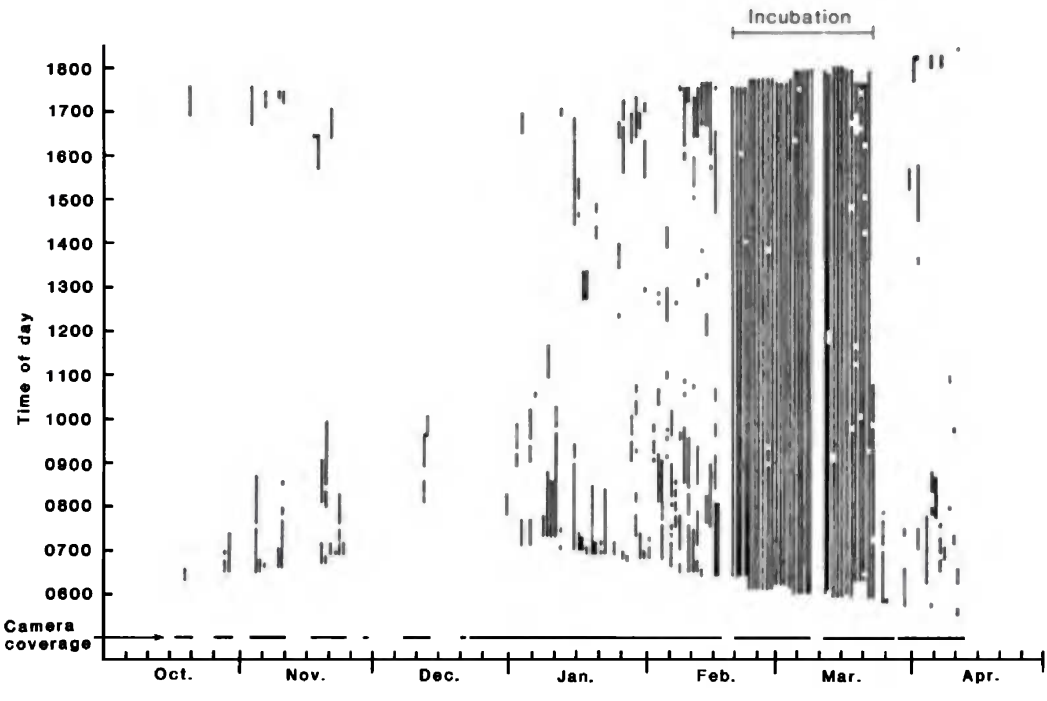


Figure 3. — Bald Eagle presence at the artificial nest structure shown in Fig. 1, October 1978 - April 1979, as recorded by time-lapse photographic sampling.

Results

Figure 3 shows the daily time on the nest by one or both adults during the study period. No eagles were observed in the area during the approximately 6 hours required to erect the scaffolding and construct the new nest. Time-lapse films before and after 21 December indicate sporadic (Fig. 3, 4b) but consistent (Fig. 4a) attention to the nest. On 31 December, both adults were recorded at the structure adding and rearranging sticks on the new, upper nest. Although the film coverage in December was incomplete, the eagles apparently accepted

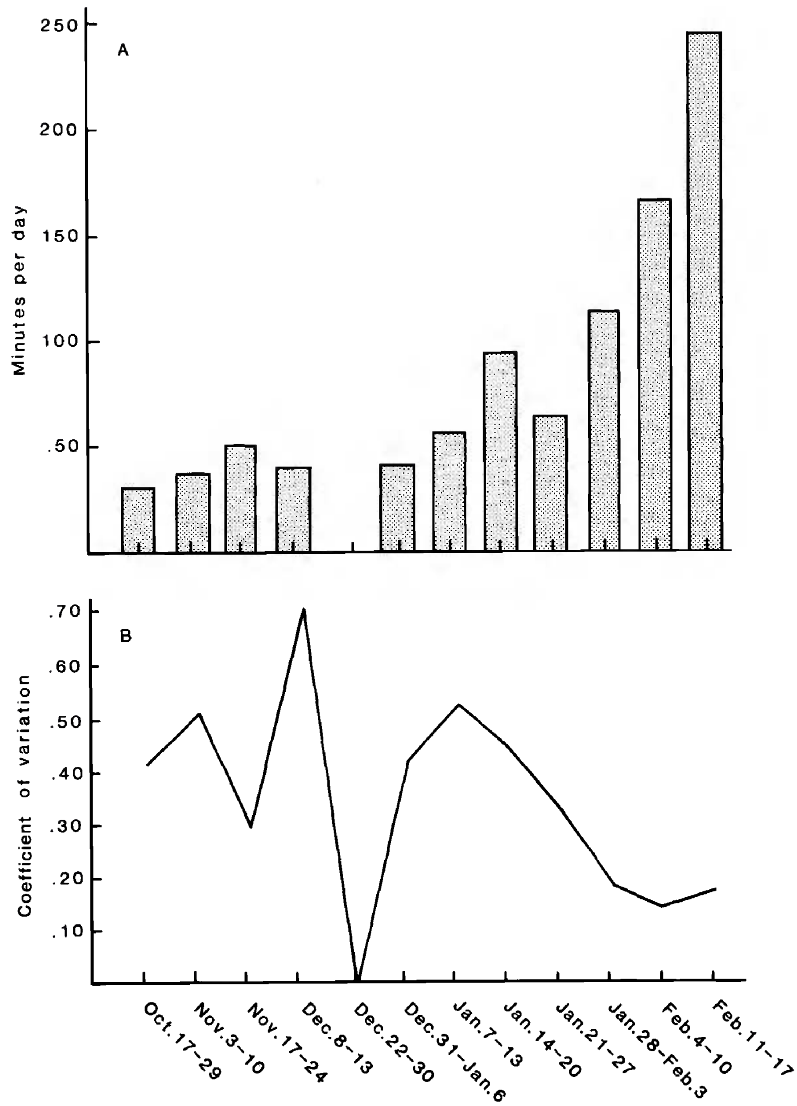


Figure 4. — (A) Average time spent by adult Bald Eagles at the tripod nest during the pre-incubation period, and (B) the coefficient of variation for average times at the nest (minutes/day).

the structure modification and relocated nest with little, if any, disruption of their previously established or subsequently recoreded, intermittent pattern of nest building activity.

Adult presence fluctuated but gradually increased through the nest repair, pre-egg-laying period, with a marked increase just prior to egg deposition (Fig. 4a). The corresponding coefficient of variation on average time-at-the-nest-per-day indicates large initial variation and steady decrease as egg laying was approached (Fig. 4b). Neither adult was recorded on the nest during midday hours until 6 January, more than 2 months after nest building began and about 1½ months before egg laying (Fig. 3). Throughout most of the pre-egg-laying period the eagles were present only while the tripod was in the shadows of early morning or late afternoon, well before or long after the nest was in direct sun. However, the amount of daytime presence increased as egg laying approached.

In the 2 weeks prior to egg laying, which apparently occurred between 17 and 20 February when full time incubation began, an adult was in the incubating posture on 9 different days for an average of about 35 minutes per day. Table 1 summarizes these observations by date, length of incubating posture activity, and time of day. In a pattern similar to that recorded for adult presence from the onset of nesting, 14 of 15 bouts of incubation posture occurred during morning and evening hours. Only on the last day of record before incubation began was this behavior seen during midday hours.

Table 1. Incubation posture prior to egg laying. (Early morning designates activity during the first hour of photographic sampling, beginning about 1 hour after first light. Morning activity occurred within the second hour of sampling. All evening activity was within the last hour of filming, up to about 1 hour before dark.)

Date	Time in Incubating Posture (nearest 10 min.)	Time of Day
February		
6	30	Early morning*
9	10	Morning
	10	Late evening*
10	20	Early morning*
	20	Morning
11	20	Late evening
12	10	Morning
	30	Late evening
14	20	Late evening*
15	30	Morning
	30	Late evening
16	30	Early morning
	10	Midday
17	30	Early morning*
18-20	720	Full-time incubation

* Incubation posture continued after photographic sampling ceased, or was already in progress when filming began.

No pattern in the simultaneous presence or activity of both adults was apparent through the study period. Both birds were present at the nest (on the nest itself or perched on one of the tripod branches) during approximately 50% of the eagle observations recorded. Both adults also actively repaired the nest following failure. Three occasions of perching by Great Blue Herons (*Ardea herodias*) and an immature Bald Eagle indicate the resident pair was not within sight of the nest during those periods. On 15 site visits between 12 October and 20 February, adults were observed only 5 to 6 times.

Feeding on the nest was noted 7 times. Four occasions were recorded on film during the pre-incubation period — 15 and 18 January, and 12 and 17 February. Both adults were involved on three occasions. On 20 February, the incubating bird was observed to fly from the nest and return with a small prey item, which was consumed at the nest edge. Fresh feathers and avian bones, mostly American Coot (*Fulica americana*), found in the nest on 13 and 16 April evidence at least two additional feedings at the nest following failure.

On 71 oicasions, at least 1 eagle was present during either the first or last frames of the day (48 and 23 respectively). Overnight roosting was suspected only when an eagle was recorded in the same position on a perch during the last footage of the evening and during the first frames of the followng morning. Six such instances were recorded: 31 January; 9, 13, 16, and 17 February; and 5 April. The incubation period when nest attendance was full-time was not considered.

The post-failure pattern of nest attendance was similar to the sporadic nest attendance of early January (Fig. 3). Behavioral similarities were also noted: more sticks were added and the nest bowl was reshaped and relined with herbaceous material, including some fresh green leaves. The nest structure was used occasionally by both adults for perching and feeding; overnight roosting was suspected once. The cause of failures, which occurred by 23 March when incubation ceased, is unknown. Breakage due to thin egg shells is suspected since small, membraneous shell fragments were later found in the nest.

Precipitation (days, amount, and deviation from normal) and eagle presence (frequency and duration) were compared on both a monthly and daily basis. Despite the heavy rains of November, December, and January (more than 10 cm above the 10-year average each month), no related variation in the overall trend of nest attendance or behavior was evident.

Discussion

Several biases are inherent with this time-lapse method of recording data. The inability to record eagle presence during the first and last hours of daylight has already been mentioned. Nest visits less than the 6-minute interval between samples also went unrecorded. In addition, because of technical or logistical difficulties, there were occasional gaps in the time-lapse coverage, especially during the first months of activity. Finally, the time-lapse camera was focused on the nest structure and thus provided no information on the presence of the adults elsewhere in the breeding area.

Freshly added nest materials and castings below the tripod indicated Bald Eagles were frequenting the tripod nest prior to 19 October, when they were first recorded on film. Nest building and using the nest as a feeding station apparently continued beyond mid-April, when camera coverage ended. These observations along with the photographic limitations described above, suggest conservative findings.

Variations in daily and weekly presence (Figs. 3, 4) may be explained by a changing prey base that could sometimes require greater foraging effort to procure. Such patterns could also represent gradual intensification of nesting activity and site attachment as the season progresses. Field and photographic observations suggest that the breeding pair is absent from the nest site much of the time prior to egg laying, and that other species may perch on the occupied nest during the eagles' absence. The first midday presence of eagles at the tripod nest (6 January) coincides with the first records of feeding (15 January) and suspected overnight roosting (31 January) on the nest. Both these activities were recorded several additional times through the beginning of incubation, a period during which midday attendance also increased.

Most survey efforts across the country are conducted during daylight hours for obvious reasons (Grubb et al. 1975, Grier et al, 1981). It follows that most observations are made through the midday period. Conceivably nests considered unoccupied at the usual survey time may have early season activity that would only be evident during dawn and/or dusk checks. Nest repair activity has been observed in other areas during the fall and winter months, well before the onset of nesting (in Arizona, New Mexico, and Washington, pers. observation; in the Great Lake region, Sergej Postupalsky, pers. comm.; and in Saskatchawan, Jon Gerrard, pers. comm.).

The cause of the thin-shelled eggs and subsequent nest failure in 1979 is undetermined. One of the eagles had a few dark feathers behind its eyes and on the back of its head, which suggests immaturity and the possible recruitment of a new member in the pair. Pesticide contamination is a possible (Bogan and Newton 1977) but improbable (Grubb and Rubink 1978) cause of failure, as is an increased thermoregulatory energy expenditure due to the inclement weather (Stalmaster 1981). Heavy rains may also have reduced prey availability by causing poor visibility in murky waters or by driving prey from the area by flooding. A probable consequence of unusually heavy precipitation is shown in Figures 3 and 4 for the week of 22-30 December, when the adults were totally absent after the tripod nest was inundated by high waters.

Adult presence and activity following nest failure indicate residual nesting behavior (Fig. 3). Similarly in 1977, when the nest tree fell after 27 days of incubation, this pair was observed adding sticks and reshaping their alternate cliff nest. Activity diminished within a month, and no eggs were ever laid. In contrast, at two other central Arizona sites that have failed collectively three times in recent years, with infertile or addled eggs, the adults have abruptly ceased attending the nest after up to 10 weeks' incubation, with no further nesting activity noted. These observations lead to the hypothesis that the amount of post-failure nesting activity in Bald Eagles is inversely proportional to the length of time spent in incubation.

Management Implications

Acceptance of the tripod, and the scaffolding modification during nest repair, demonstrate the remarkable adaptability of nesting Bald Eagles. There is thus a potential for managers to provide artificial nests or nesting structures when natural nests are destroyed or suitable trees are lacking. The tripod was originally designed because of this pair's tendency to nest in short-lived, willow (*Salix goodingii*) snags. Dunstan and Borth (1970) and Postupalsky (1978) have had success in replacing fallen nests in trees, while several Arizona nests have also been successfully placed in both trees and cliffs (Grubb *et al.*, 1982). However, artificial manipulation should be employed only when justified by careful consideration of the alternatives.

Even though the early season activity and diurnal patterns of nest attendance require further documentation and verification, alteration of early season survey techniques and management practices may be warranted. The presence of breeding adults more than 4 months before egg laying, if consistent, could lead to managing for a reduction in potentially disturbing activities, especially during dawn and dusk hours, much earlier in the nesting season. Similarly, it maybe necessary to conduct early season nest surveys during the early and late hours of the day. Observation of post-failure activity suggests that if failure occurs after a lengthy incubation or into the nestling period, it is highly unlikely that the birds will renest. Thus, management restrictions could be eased, if necessary; whereas with early nest failure near or shortly after the onset of incubation, site protection and monitoring should be continued.

Acknowledgments

Jon Gerrard, Sergej Postupalsky, and Art Renfro provided helpful reviews of an earlier draft. Journal reviewers contributed significantly to the final manuscript.

Literature Cited

Bogan, J. and I. Newton. 1977. Redistribution of DDE in Sparrowhawks during starvation. *Bull. Environ. Contam. and Toxicol.* 18:317-321.

Dunstan, T.C. and M. Borth. 1970. Successful reconstruction of active Bald Eagle nest. *Wilson Bull.* 82:326-327.

Grier, J.W., J.M. Gerrard, G.D. Hamilton, and P.A. Gray. 1981. Avian-visibility bias and survey techniques for nesting Bald Eagles in northwestern Ontario. *Journ. Wild. Manage.* 45:83-92.

Grubb, T.G. 1980. An artificial Bald Eagle nest structure. USDA Forest Service Research Note RM-383. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. 4 pp.

Grubb, T.G. and D.M. Rubink. 1978. First Bald Eagle eggs collected for analysis in Arizona. USDA Forest Service Research Note RM-352. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. 2 pp.

Grubb, T.G., D.A. Manuwal, and C.M. Anderson. 1975. Nest distribution and productivity of Bald Eagles in western Washington. *Murrelet* 56:2-6.

Grubb, T.G., D.M. Rubink, S.W. Hoffman, and L.A. Forbis. 1982. Management of breeding Bald Eagles in Arizona — problems and perspectives. *IN* Proceedings of Bald Eagle Days 1982. T.N. Ingram, editor. Eagle Valley Environmentalists, Inc., Apple River, Illinois. p. 73-88.

Postupalsky, S. 1978. Artificial nesting platforms for Ospreys and Bald Eagles. *IN* Endangered Birds — Management techniques for preserving threatened species. S.A. Temple, editor. University of Wisconsin Press, Madison. p. 34-45.

Rubink, D.M. and K. Podborny. 1976. The Southern Bald Eagle in Arizona — a status report. U.S. Fish and Wildlife Service, Endangered Species Report 1. Albuquerque, New Mexico. 33 pp.

Stalmaster, M.V. 1981. Ecological energetics and foraging behavior of wintering Bald Eagles. Ph.D. dissertation. Utah State University, Logan. 157 pp.

1984 RAPTOR RESEARCH FOUNDATION MEETING

The 1984 annual meeting of the Raptor Research Foundation, Inc., will be held October 25-28 at Virginia Polytechnic Institute and State University, Blacksburg, Virginia. The tentative schedule is:

25 October	Workshops
26-27 October	Paper and poster sessions
27 October	Banquet
28 October	Open

For further information, program suggestions, or space requests, contact:

Dr. Jim Fraser, Department of Fish. & Wildl. Sci., VPI & SU, Blacksburg, VA 24061, Ph: 703-961-6064.

ANDERSEN AWARD

The 2nd annual William C. Andersen Award for the best student paper was presented at the 1983 Raptor Research Foundation meeting in St. Louis, Missouri. The winner was Mr. Jim Duncan of the MacDonald Raptor Research Center, McGill University. Jim's paper was entitled "Mate Selection in Captive Kestrels: I. Siblings vs. Stranger

Students wishing to be considered for the 1984 Andersen Award must indicate their eligibility when submitting abstracts. Eligibility criteria were published in *Raptor Research* 16(1):30-32. Questions regarding the 1984 award should be directed to:

Dr. Robert Kennedy, Director, Raptor Information Center, National Wildlife Federation, 9412 16th Street, NW, Washington, D.C. 20036.